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RESPONSE SECTION 3

# FOCUSED SITE INSPECTION PRIORITIZATION SITE EVALUATION REPORT

AMERICAN CYANAMID SITE 1800 EAST HIGHWAY 12 MICHIGAN CITY, LA PORTE COUNTY, INDIANA

CERCLIS ID NO.: IND005159546

EPA Region 5 Records Ctr. 287192

### Prepared for:

# UNITED STATES ENVIRONMENTAL PROTECTION AGENCY SITE ASSESSMENT SECTION

77 West Jackson Boulevard Chicago, Illinois 60604

Date Prepared: July 7, 1995

U.S. EPA Region: 5

Contract No.: 68-W0-0037

Technical Direction Document No.: T05-9503-280

Prepared by: Ecology and Environment, Inc.

Donovan Robin

E & E Program Leader: Steven Skare

Telephone No.: (312) 663-9415



# ecology and environment, inc.

111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415 International Specialists in the Environment

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#### 1. INTRODUCTION

The Ecology and Environment, Inc. (E & E), Technical Assistance Team (TAT) was assigned by the United States Environmental Protection Agency (U.S. EPA), under Contract No. 68-W0-0037, Technical Direction Document (TDD) No. T05-9503-280, to evaluate the American Cyanide site in Michigan City, LaPorte County, Indiana as a potential candidate for the National Priorities List (NPL).

The purpose of assessment of sites listed in the Comprehensive Environmental Response Compensation Liability Information System (CERCLIS) data base is to determine whether these sites are candidates for inclusion in the NPL. This determination is made using the Hazard Ranking System (HRS). Any site eligible for placement in the NPL must have an overall score of 28.50. Additional investigations in the form of Screening Site Inspection (SSI) and/or Expanded Site Inspection (ESI) are conducted for those sites whose preliminary HRS Score is greater than 28.50. The site is scored or re-scored after SSI and/or ESI to determine its eligibility for placement in the NPL.

The goal of a Focused Site Inspection Prioritization (FSIP) is to gather any additional information necessary, following the completion of the SSI (prior to the implementation of the revised HRS), to help set priorities among sites for NPL listing or to screen them from further Superfund attention. FSIPs can be performed on sites with SSI completion dates prior to August 1, 1992 in CERCLIS, for these were most likely not evaluated using the revised HRS model.

The FSIPs are conducted using the revised HRS model, which was promulgated and published in the Federal Register (55 FR 51532) in December 1990 and which supersedes the original HRS. If the existing information supports the determination that additional investigation is not necessary, the site is designated as requiring no further remedial action (NFRAP). Sites can also be NFRAPed without scoring if the following conditions exist: no waste is present at the site; Site at which the only known or suspected releases to the

environment are due to petroleum products; site is regulated under the Resource Recovery and Conservation Act (RCRA).

Background information for this report was obtained from the U.S. EPA CERCLA site file, the LaPorte County Health Department, and documents provided by Criterion Catalyst, the current owner of the site. This report is organized into six sections, including this introduction. Section 2 describes the site and provides a brief site history. Section 3 provides information about previous investigations conducted at the site. Section 4 provides information about the four migration and exposure pathways (groundwater migration, surface water migration, soil exposure, and air migration). Section 5 is a summary of the FSIP. References used in the preparation of this report are listed in Section 6.

#### 2. SITE DESCRIPTION AND HISTORY

### 2.1 Site Description

The AC site is located at 2521 East U.S. Highway 12 in Michigan City, La Porte County, Indiana (sec. 22, T. 38 N., R. 4 W.). Coordinates for the site are latitude 41°44'45" North and longitude 86°52'20" West. The site is an active manufacturing facility that covers 143 acres in Michigan City, near Lake Michigan. The site location is shown on Figure 2-1. The site is bordered to the south by U.S. Highway 12, to the west and north by active sand excavation areas, and to the east by a commercial development. Site features are shown on Figure 2-2. The nearest residence is 0.2 miles west of the AC site; other residences are located 0.3 miles north of the site along Lake Michigan. Densely populated urban areas are present in Michigan City and are located 0.75 miles southwest of the AC site (United States Geological Survey [USGS] 1980; E & E 1989). Refer to Appendix A for a 4-mile radius map of the site study area.

For this report the site will be split into two portions and will be referred to as the south portion and the north portion.

The south portion of the AC site is used for manufacturing operations, shipping and receiving by railcars and trucks, parking for employees, and storage of drummed wastes. The manufacturing and drum storage areas are fenced. Two closed injection wells and two active deep injection wells used for disposal of process wastewater are also located within the fenced portion of the site (E & E 1989).

The north portion of the site was used for disposal of various process wastes in unlined pits from 1951 until approximately 1971. Some of the materials disposed were excavated and removed in 1988. This portion of the property consists of sand dunes covered with grasses, shrubs, and deciduous trees; areas formerly used for disposal are unvegetated (E & E 1989). Information available does not mention any systems, such as a fence or security guards, being employed to prevent entry into this area.

Lake Michigan is separated from the site by active sand excavation areas and lake shore developments, and lies approximately 0.3 miles north of the former disposal area. Trail Creek is located approximately 0.4 miles south of the disposal and drum storage areas on site (E & E 1989; USGS 1980). Detailed information on the runoff management at the site is not available. The description of the ground surface on the north side of the site (including the former disposal areas) suggests that most precipitation would infiltrate the sandy surface soil. Maps available for the site area suggest that runoff on the south side of the site would be directed toward two retention basins and allowed to infiltrate (Metcalf and Eddy [M & E] 1994).

### 2.2 Site History

In 1951, American Cyanamid began manufacturing alumina pellets from aluminum oxide powder, which is obtained from bauxite. In 1974, American Cyanamid began manufacturing a catalyst made from alumina pellets coated with a solution containing cobalt, nickel, and molybdenum (E & E 1989).

The site was owned by American Cyanamid between 1951 and 1988. In 1988, American Cyanamid entered into a limited partnership with the Shell Oil Company and created a new entity: Criterion Catalyst Company L.P. (Criterion Catalyst), which currently owns and operates the site (E & E 1989; Tabakin 1995).

Sludge containing sodium silicate solids (bauxite impurities) was disposed in unlined lagoons on the north side of the site between 1951 and approximately 1971. After 1971, American Cyanamid began precipitating the sludge in unlined wooden stave tanks (E & E 1989). The location of these tanks is not specified in file information currently available.

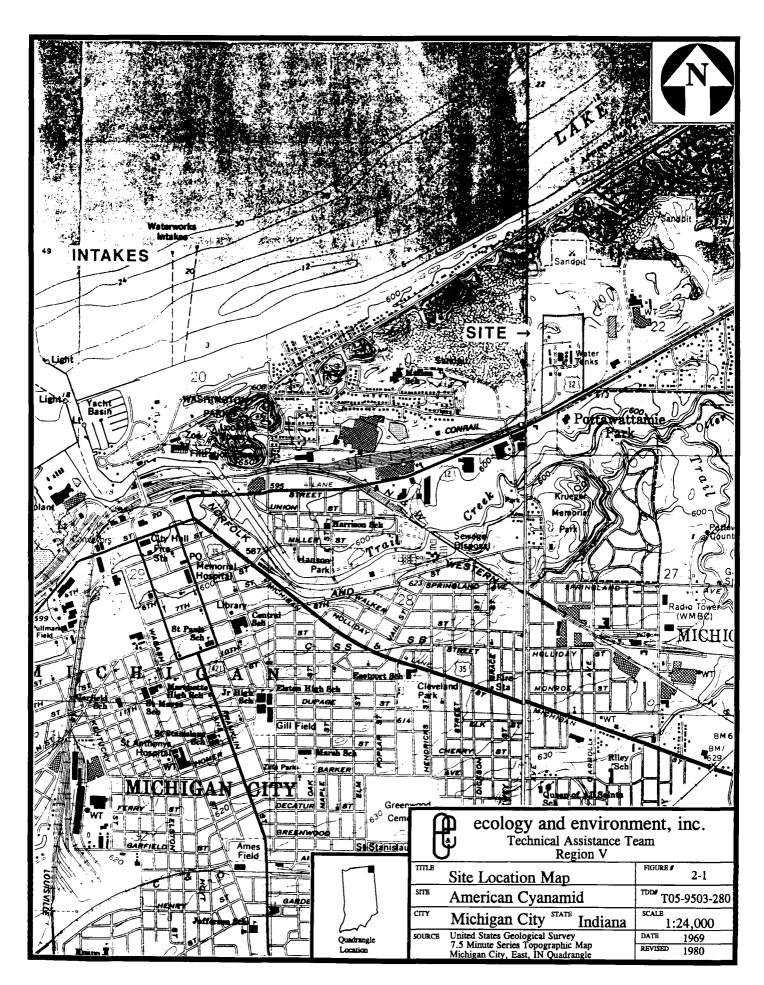
American Cyanamid also disposed of substandard alumina pellets and catalyst in unlined landfills on the north side of the site. Disposal of these materials ended sometime between 1974 and 1988. At the time of the SSI in 1989, 2,400 tons of waste catalyst and pellets had been removed from the site by Chemical Waste Management and disposed of at Adams Center Landfill in Fort Wayne, Indiana, under contract to the site owners. Information on the extent of the removal provided to E & E by the site owner is included in Appendix B. According to site representatives the waste catalyst did not meet the hazardous waste criteria of the Resource Conservation and Recovery Act (RCRA) (E & E 1989).

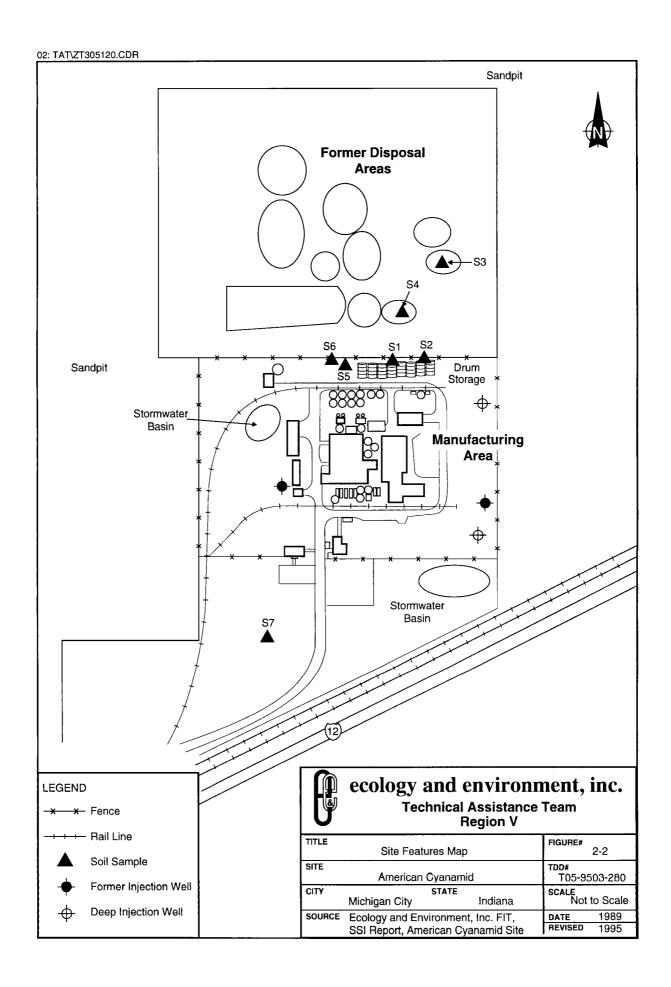
At the time of the SSI, American Cyanamid had stocked approximately 275 drums of waste alumina pellets and catalyst in drums on wooden pallets in an undiked outdoor area inside the fenced manufacturing area. Two drums of waste catalyst mixed with mercury were stored in a locked, diked shed in the manufacturing area. This waste material was generated by a laboratory on site that uses mercury to test the porosity of the alumina pellets and catalyst. Drumming of this waste began in 1980 (E & E 1989). Information on prior handling of this waste is not available.

Two injection wells were used to dispose of process wastewater containing sodium sulfate and ammonium sulfate into a limestone and sandstone aquifer beneath the site. One well, located on the southwest side of the site had a injection depth of 270 to 650 feet below ground surface (BGS). The second well, located on the southeast side of the site has an injection depth of 270 to 295 feet BGS. These wells were installed between 1951 and 1952 and were closed in 1988 (E & E 1989). Refer to Appendix C for information on closure of the wells provided to E & E by the site owner.

American Cyanamid submitted a RCRA Part A notification for inclusion of the AC site as a treatment, storage, and disposal facility on November 15, 1980 and requested a withdrawal of the notification on November 5, 1982. The withdrawal was approved on September 13, 1984 (E & E 1989).

In 1989, Criterion Catalyst identified an area on the south side of the facility where the pH of subsurface soil and groundwater in the shallow aquifer had been elevated by a release from a raw materials tank farm where ammonia hydroxide, caustic soda, and acids were stored; IDEM has been notified of this release. Refer to Appendix D for a copy of the narrative portion of an assessment report related to this release prepared for Criterion Catalyst by Metcalf and Eddy in 1994. Currently, Criterion Catalyst is in the process of retaining a contractor to complete a feasibility study and risk assessment related to this release (Tabakin 1995).





### 3. PREVIOUS INVESTIGATIONS

The AC site was initially placed on the CERCLA database in September 1980 in response to an anonymous report to U.S. EPA of waste disposal at the site. The site was also included on the 1979 "Ekhardt Report" of waste disposal sites prepared for the U.S. Congress (E & E 1989).

In 1980 and 1986, U.S. EPA conducted inspections of the AC facility. In 1986, U.S. EPA sampled the water being disposed of in the injection wells. According to information available, the sample contained high levels of dissolved solids, sulfate, sodium, and nitrate, and did not contain detectable levels of pesticides, herbicides, or cyanide (E & E 1989). Information on levels of volatile organic compounds, semivolatile organic compounds, and heavy metals detected in the sample is not available.

In December 1986, U.S. EPA denied American Cyanamid permission to continue use of the injection wells. In 1988, U.S. EPA issued a consent order to American Cyanamid to cease use of the existing wells and install two deep wells (4,500 feet deep) for disposal.

A preliminary assessment (PA) of the AC site was performed by the Indiana Department of Environmental Management (IDEM) in 1986. IDEM reported potential contamination of groundwater and surface water from the site and listed heavy metals, organic compounds, inorganic compounds, solvents, bases, and acids as chemicals of concern in the PA report (IDEM 1986).

In 1989, FIT completed the SSI of the site. The SSI included sampling of surface and subsurface soil in the disposal area on the north portion of the site and near the drum storage area. The majority of Target Analyte List and Target Compound List (TAL/TCL) chemicals detected above background levels were detected in composite soil sample S3 collected from one of the former disposal areas. The SSI report indicates that excavation of disposed materials was continuing in the area of sample S3 at the time of the SSI (E & E

1989). A summary of TAL/TCL chemicals detected in soil sample S3 above background levels is provided in Appendix E.

The SSI also included sampling of two irrigation wells at a golf course. These wells, whose depths are not known, were located approximately 1.5 miles northeast of the site. No TAL/TCL chemicals attributable to the site were detected in the wells sampled.

### 4. MIGRATION AND EXPOSURE PATHWAYS

This section describes the four migration and exposure pathways associated with the AC site. Section 4.1 discusses the groundwater migration pathway; Section 4.2 discusses the surface water migration pathway; Section 4.3 discusses the soil exposure pathway; and Section 4.4 discusses the air migration pathway.

#### 4.1 GROUNDWATER MIGRATION PATHWAY

This section discusses regional geology and soils, groundwater releases, and targets associated with the groundwater migration pathway at the site. The AC site is located in an area of lacustrian sand deposits and glacial till on the shore of Lake Michigan. The residents of Michigan City obtain drinking water from a municipal system that maintains an intake located on Lake Michigan, approximately 0.5 miles off shore, and 1.5 miles from the site (E & E 1991).

### 4.1.1 Geology and Soils

Two aquifers are present in the site study area. The upper aquifer consists of unconsolidated lacustrine sands over clayey sandy silt over glacial till with lenses of sand and gravel. This aquifer is highly permeable and is used as a drinking water source according to area well logs. Depth to groundwater in the site vicinity is generally between 15 and 20 feet BGS. The direction of groundwater flow in this aquifer is assumed to be north toward Lake Michigan (E & E 1989). The direction of groundwater flow may be influenced by the operation of sand excavation pits adjacent to the north and west sides of the site; however, the extent of this influence is not known (E & E 1989; USGS 1980).

A layer of shale, beginning at approximately 200 feet BGS, separates the upper aquifer from the lower aquifer. This layer is generally reported to be between 50 and 80 feet

thick in area well logs. This layer is not considered to be an aquifer, but is not a complete confining layer in the study area due to the presence of preglacial stream incisions, which would allow exchange between the upper and lower aquifers (E & E 1989).

The lower aquifer is a karst aquifer formed of limestone and sandstone, and is generally used for irrigation and industrial purposes according to area well logs. Pressure created by the overlying layer of shale creates artesian conditions in some wells finished in this aquifer according to area well logs. The former injection wells at the AC site discharged into this aquifer (E & E 1989). Groundwater flow direction in this aquifer is not known and may be influenced by the presence of caverns and solution channels within the limestone portions of this aquifer (Freeze 1979). The presence of sand excavation pits adjacent to the site suggests that surface soils at the site are coarse lacustrian sands (USGS 1980).

#### 4.1.2 Groundwater Releases

No engineered systems for control or containment of material disposed of on the north side of the site (e.g., liners or a leachate collection system) are known to have been constructed, removal of materials disposed on the north side of the site occurred in 1988. Information on the removal is provided in Appendix B. No monitoring wells are known to have been installed on this side of the site.

Two injection wells were formerly used to dispose of process wastewater containing sodium sulfate and ammonium sulfate into the lower limestone and sandstone aquifer beneath the site. One well, located on the southwest side of the site had a injection depth of 270 to 650 feet below ground surface (BGS). The second well, located on the southeast side of the site had an injection depth of 270 to 295 feet BGS. These wells were installed between 1951 and 1952 and were closed in 1988 (E & E 1989). Refer to Appendix C for information on closure of the wells provided to E & E by the site owner. Currently, Criterion Catalyst disposes this wastewater into two Class I deep wells under IDEM permit numbers IN-091-1I-0001 and IN-091-1I-0002 (Tabakin 1995).

A release to groundwater from a raw materials tank farm which stored ammonia hydroxide, caustic soda, and acids was discovered in 1989; further information on this release is provided in Appendix D.

#### 4.1.3 Targets

The nearest well to the site identified in the SSI report is located 1.5 miles northeast of the site; this well draws from the limestone aquifer and is used to supply an irrigation system at a golf course (E & E 1989). No residential drinking water wells are known to be located within the Michigan City municipal waster supply system according to the LaPorte County Health Department (Livinghouse 1995). The nearest residential wells are located in Springfield township, approximately two miles west of the site. A summary of groundwater targets for the study area is provided in Appendix F.

#### 4.2 SURFACE WATER MIGRATION PATHWAY

FIT did not identify any overland migration routes to nearby surface water bodies or collect surface water or sediment samples during the SSI (E & E 1989). The presence of sand excavation pits adjacent to the site suggests that precipitation infiltrates rapidly, resulting in little surface runoff. Runoff from the south side of the site is collected in basins and allowed to infiltrate.

Nearby surface water bodies include Lake Michigan, located approximately 0.3 miles north of the disposal and drum storage areas on the north side of the site, and Trail Creek, located approximately 0.4 miles south of the disposal areas (USGS 1980).

Michigan City maintains a surface water intake located approximately 0.5 miles off shore in Lake Michigan and 1.5 miles northwest of the site (USGS 1980). This intake is the source of drinking water for approximately 40,000 residents (E & E 1989).

### 4.3 SOIL EXPOSURE PATHWAY

The disposal areas on the north side of the site are not secured and TAL/TCL chemicals were detected above background levels in this area. The manufacturing area is fenced and 24-hour security is present according site representatives (E & E 1989). No resident population or day-care centers within 200 feet of the contaminated soil area have been identified based on an examination of the USGS topographic map of the site, and observations made by FIT (E & E 1989). Approximately 105 persons work on site. The nearest residence is located approximately 0.3 mile north of the site (USGS 1980). The number of workers on site and the population within 1 mile of the site are summarized in Appendix F.

### 4.4 AIR MIGRATION PATHWAY

FIT did not observe a release to air during the SSI. The LaPorte County Health Department reported that a release of aluminum oxide from the manufacturing operations occurred in 1992 (Livinghouse 1995). However, information available indicates that a release of hazardous substances from the disposal areas on site to air is not likely to occur. A summary of residents within the four-mile radius study area is provided in Appendix E.

#### 5. SUMMARY

The American Cyanamid site covers 143 acres and includes an active manufacturing facility operating since 1951, and an associated area where process wastes were formerly disposed. The site is currently owned and operated by Criterion Catalyst. In 1988, Criterion Catalyst excavated some of the areas previously used for disposal; samples collected from these areas by FIT prior to the completion of the excavation contained levels of various TAL/TCL chemicals including aluminum, nickel, and fluoranthene above background concentrations (E & E 1989). Further details on the excavation are provided in Appendix B.

The site is located 0.3 mile south of Lake Michigan, on permeable, sandy soils. The water table is expected to be within 20 feet BGS (USGS 1980). Two aquifers exist beneath the site. The upper aquifer is formed in unconsolidated lacustrine sands; groundwater in this aquifer is expected to flow north, toward Lake Michigan. The lower aquifer is incompletely separated from the upper aquifer by a layer of shale and occurs in a formation of karst limestone and sandstone; the direction of flow within this aquifer cannot be predicted (E & E 1989). The nearest residential wells are located approximately 2 miles west of the site and are finished in the upper aquifer.

Residents of Michigan City receive drinking water from an intake on Lake Michigan located approximately one half mile off shore, and 1.5 miles northwest of the site. The south side of the site is secured by a fence and security guard. The north side is generally isolated from public access (E & E 1989; USGS 1980). No incidents of exposure of residents or trespassers to materials disposed on site have been reported or documented in the information available.

Criterion Catalyst has made an assessment of a release to groundwater of material from an area where caustic soda, ammonia hydroxide, and acids were stored. IDEM has

been notified of the release and Criterion Catalyst is in the process of obtaining a contractor to perform a feasibility study and risk assessment for the release (Tabakin 1995).

### 6. REFERENCES

- Ecology and Environment, Inc., 1991, Expanded Site Inspection Prioritization Questionnaire, American Cyanamid Site, U.S. EPA ID No.: IND005159546, Chicago, Illinois.
- \_\_\_\_\_\_, 1989, Screening Site Inspection Final Report, American Cyanamid Site, U.S. EPA ID No.: IND005159546, Chicago, Illinois.
- Freeze, R. Allen and John A. Cherry, 1979, *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
- Livinghouse, Danielle, May 12, 1995, LaPorte County Health Department, Telephone Conversation with Donovan Robin of E & E TAT, Chicago, Illinois.
- Metcalf & Eddy, June 22, 1994, Revised Draft Summary Report, Raw Materials Tank Farm, Itasca, Illinois.
- Tabakin, Richard, June 2, 1995, Manager, Regulatory Services, CYTEC, letter, to Donovan Robin of E & E TAT, Chicago, Illinois.
- United States Geological Survey, 1980, 7.5 Minute Series Topographic Map, Michigan City East, Indiana Quadrangle, Reston, Virginia.

# APPENDIX A 4-MILE RADIUS MAP

# $SDMS\ US\ EPA\ Region\ V$

Imagery Insert Form

Some images in this document may be illegible or unavailable in SDMS. Please see reason(s) indicated below:

Confidential Business Information (CBI). This document contains highly sensitive information. Due to confidentiality, materials with s information are not available in SDMS. You may contact the EPA Superfund Records Mana wish to view this document.  Specify Type of Document(s) / Comments:  Unscannable Material: Oversized orx Format. Due to certain scanning equipment capability limitations, the document page(s) is not available SDMS.  Specify Type of Document(s) / Comments:	Unless otherwise no	OR or RESOLUTION variations.  oted, these pages are available in monochrome. The source document page images. The original document is available for viewing at the Superfun   Specify Type of Document(s) / Comments:
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# APPENDIX B REMOVAL OF WASTE ON NORTH SIDE OF SITE

# CYTEC

CYTEC INDUSTRIES INC.

Warners Plant P.O. Box 31 Foot of Tremley Pt. Rd. Linden, NJ 07036 Tel: (908) 862-6000 June 2, 1995

Certified Mail Return Receipt Requested

Mr. Donovan Robin, Environmental Scientist Ecology and Environment 111 West Jackson Boulevard Chicago, IL 60604

Re: Focused Site Inspection Prioritization American Cyanamid Company Site 1800 East U.S. Highway 12 Michigan City, IN 46312

Dear Mr. Robin:

This is in response to your letter of May 23, 1995 addressed to Mr. Mark Karabatak at the Criterion Catalyst Company, L.P. ("Criterion") plant in Michigan City, IN. Cytec responds on behalf of Criterion as the current owner of the plant property, because Cytec owns, through subsidiaries, a 50 percent interest in Criterion.

1. <u>Description of soil excavation and removal in disposal areas on North side of property (IPB-2 Catalyst Disposal Area).</u>

In May, 1988, approximately 2400 tons of soil, mixed with off-specification IPB-2 catalyst, were removed from two areas (designated as "A" and "B", see Figure 1) on the north portion of the site. These materials were disposed at the Chemical Waste Management Adams Center landfill in Ft. Wayne, IN (see IDEM Special Waste Disposal Approval, Exhibit 1.) Prior to the voluntary removal action, three soil samples containing the off-specification catalyst were collected (see Exhibit 2) and subjected to EP Toxicity testing for the specified metals and nickel, a non-EP toxic parameter. The results clearly indicated that the material was not RCRA hazardous, but did contain EP-extractable levels of nickel ranging from 26.6 to 69.7 mg/L.

The off-specification IPB-2 catalyst, which has a green color, consists of nickel and tungsten fluoride salts impregnated on an alumina substrate. The material was apparently deposited in the two designated areas some time prior to 1975. Removal was accomplished by backhoe and front-end loader until no significant residues of green solids were visibly evident. This was documented by Polaroid photographs (which are retained in our files.) Following completion of the removal, a total of 12 post- excavation samples were collected from the two designated areas (see Exhibit 3) and these were subjected to the EP Toxicity testing. Cobalt, molybdenum and nickel, commonly

used in the catalyst products manufactured at the plant, were also analyzed using the EP Toxicity protocol. The results of these analyses (York Laboratories report dated July 19, 1988, see Exhibit 4) again confirmed the non-hazardous character of the residual soils and also indicated substantially reduced levels of EP-extractable nickel, ranging from 0.11 to 3.13 mg/L. The excavated areas were subsequently graded with on-site soils.

The areas from which the catalyst was removed were also observed and sampled by the Ecology and Environment FIT team during their Screening Site Inspection (SSI) for EPA, May 31 to June 1, 1988. Their observations and data are included in a report issued on March 10, 1989 (see relevant pages, Exhibit 5.) A single soil sample, designated S-3, was collected and analyzed for various TCL compounds and TAL analytes. The principal constituents detected were aluminum (23,100 mg/Kg); calcium (2,150 mg/Kg); iron (2,380 mg/Kg) and nickel (3,940 mg/Kg). Note that these analyses are "total" metals and

cannot be directly compared to the EP-extract data. According to the SSI report, sample S-3 was noted to contain a "green solid which appeared to be discarded nickel catalyst"; since the sample was taken from a small, isolated pocket of surface residue because of its appearance under QA/QC principles, it should not be considered to be representative of the residual level of constituents in the remediated area.

# 2. Remediation of High pH Groundwater

Criterion has identified and eliminated the identified sources that contributed to the elevated pH at the site. In conjunction with Cytec, Criterion retained Metcalf & Eddy (Itasca, IL) to investigate and characterize the nature of the groundwater contamination. The results of this study were forwarded to IDEM in a letter dated September 26, 1994 (see Exhibits 6 and 7) as part of the ongoing voluntary corrective action program. Details on the number and location of monitoring wells and geoprobe borings are referenced in the Metcalf & Eddy report. Criterion and Cytec are in the process of retaining a contractor to complete a feasibility study and risk assessment relating to groundwater at the site.

### 3. Closure of Former Injection Wells

ar Cotto

Refer to report dated January 7, 1993 by Golden Environmental Services, Inc. (Houston, TX) for details on the closure process and date of completion. This report was issued to EPA Region V in a letter dated January 25, 1993 (see Exhibit 8.)

# 4. Permit Numbers for New Injection Wells

EPA Region V assigned the two class I wells permit numbers IN-091-1I-0001 and IN-091-1I-0002.

Please advise if additional information is required.

Very truly yours,

Richard B. Tabakin

Manager, Regulatory Services

**Enclosures** 

Table F-3

### AIR PATHWAY TARGETS AMERICAN CYANAMID SITE MICHIGAN CITY, INDIANA U.S. EPA ID NO.: IND005159546

Distance Interval Number of Residents On Site 105 (workers) 0 - 1/4 mile 650 1/4 - 1/2 mile 2,950 1/2 - 1 mile 2,930 1 - 2 mile 14,612 2 - 3 mile 12,442 3 - 4 mile 15,000

Source: E & E FIT, 1991 ESIP Questionnaire, American Cyanamid Site.

cc: Tom Martz - Criterion (Michigan City) Alberto Delgado - Criterion (Pittsburg) Karen Koster - Cytec (West Paterson)

bcc: C. French
G. Campbell
R. Hillard



# INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT NANCY A. MALOLEY, Commissioner

105 South Meridian Street

P.O. Box 6015

Indianapolis

46206-6015

Telephone

317-232-8603

# Office of Solid And Hazardous Waste Management Special Waste Disposal Approval

Case No. \_\_\_ACI. 438

The following State Permitted Sanitary Landfill

JUN 29 1988

Adams Center Landfill, OPP No. 02-1 4636 Adams Center Road Fort Wayne, Indiana 46806

is authorized by the Indiana Department of Environmental Management, Office of Solid and Hazardous Waste Management, to dispose of:

4,000 cubic yards of off-spec catalyst

from the following generator:

American Cyanamid 1800 E. U.S. Hwy 12 Michigan City, IN 46360

This approval shall expire on June 30, 1989 Special conditions that apply to this approval are indicated on the reverse side.

Jane Magee

Assistant Commissioner for Solid and Hazardous Waste

Management

Date

6/17/88

# GENERAL CONDITIONS THAT APPLY TO ALL SPECIAL WASTE APPROVALS:

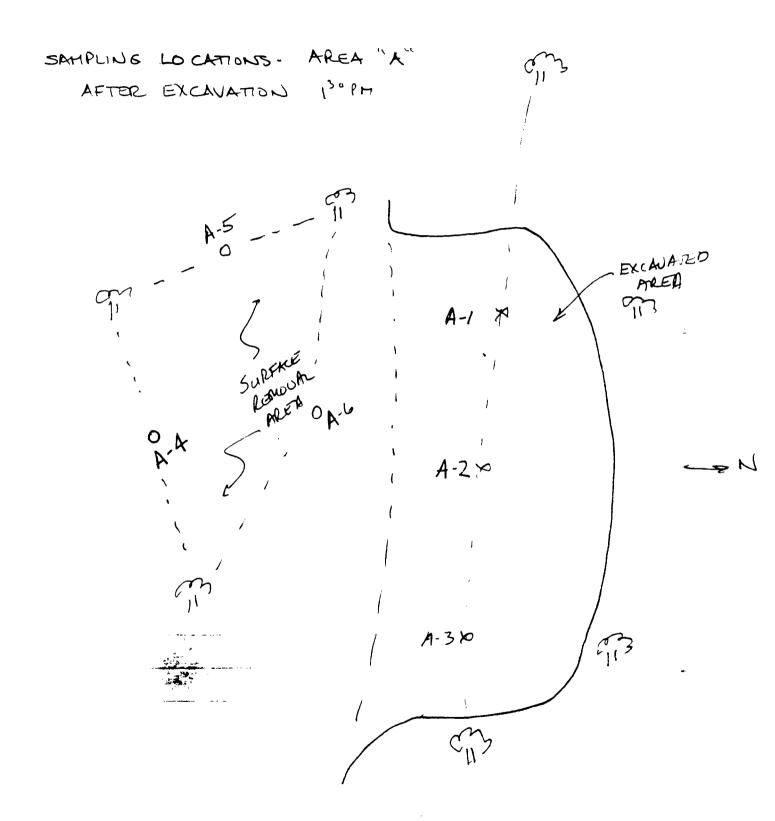
- 1. The generator and/or hauler shall provide the landfill with advanced notification of intended disposal.
- 2. If nuisance or pollution conditions are created, immediate corrective action will be taken by the operator.
- 3. Waste material accepted under this approval shall be included on the Special Waste Monthly Report to be submitted to this office monthly.
- 4. This approval will be revoked if the landfill fails to maintain compliance with 330 IAC 4-1, et seq. (Regulation SPC 18).

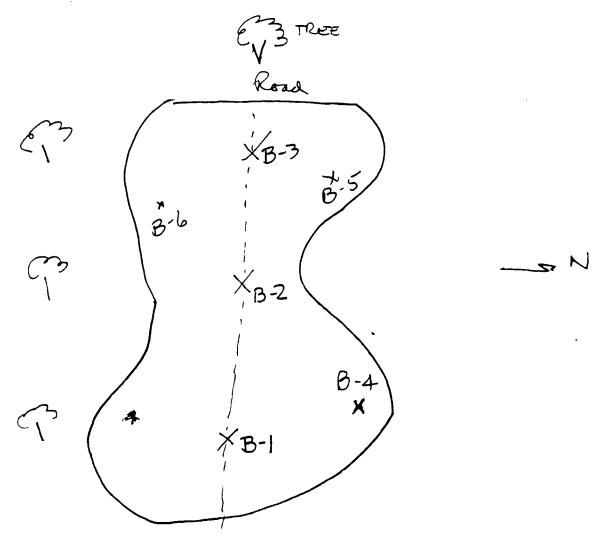
# SPECIAL CONDITIONS THAT ARE REQUIRED FOR DISPOSAL OF THIS WASTE WILL BE INDICATED BY THE REVIEWER'S INITIALS:

1.	This waste shall not contain free liquids.					
2.	This waste shall contain a minimum of free liquids.					
3.	This waste shall not present a fire or explosion hazard.					
4.	At least one end of the container shall be completely opened					
	so that the waste can be readily identified.					
5.	Specific conditions concerning asbestos disposal are attached.					
<u> 10</u> 6.	This approval amends the May 16, 1988 by increasing the					

Reviewer/Date Section Chief/Date Branch Chief/Date

CC. Allen County Health Department
Facility Inspection Section Chief - North
American Cynamid Corporation





APPLOY. SOIL SAMPLING LOCATIONS

ALEA" B" 5/26/88 1045 A.M.

AFTER EXCAVATION

The state of the state of the



JUL 20 1988

### REPORT TRANSMITTAL

REPORT NUMBER \_\_\_\_\_\_\_

DATE \_\_\_\_\_July 19, 1988

CLIENT

Criterion Catalysts Company, LP Michigan City Plant 1800 E. U.S. Highway 12 Michigan City, IN 46360-2074

ATTENTION M.S. Wilkenfeld

The above referenced report is enclosed. Copies of this report and supporting data will be retained in our files in the event they are required for future reference.

If there are any questions concerning this report, please do not hesitate to contact us.

Any samples submitted to our Laboratory will be retained for a maximum of sixty (60) days from receipt of this report, unless other arrangements are desired.

Very Truly Yours.

ROBERT Q. BRADLEY Vice President/Principal

Robert Q Bradleylinis

### July 19, 1988

30880-1039 CRITERION CATALYSTS COMPANY, LP Michigan City Plant 1800 East U.S. Highway 12 Michigan City, Indiana 46360-2074

Attention: Mr. M.S. Wilkenfeld

### PURPOSE

Twelve (12) soil samples were submitted to York Laboratories Division of YWC, Inc. by Criterion Catalysts Company, LP. The client requested that the samples be analyzed for E.P. toxicity characterization (metals only) including cobalt, molybdenum and nickel.

### METHODOLOGY

The samples were prepared according to Method 1310 of <u>Test Methods for Evaluating Solid Wastes</u>, SW846, 2nd edition.

Analyses were done according to Methods 6010 and 7470 of <u>Test Methods for Evaluating Solid Wastes</u>, SW846, 3rd edition.

### RESULTS

The results are presented in the following Tables.

Prepared by:

Q. Curran

Manager

JCC/md

The liability of YWC, Inc. is limited to the actual dollar value of this project.

### TABLE 1.0 30880-1039 CRITERION CATALYSTS COMPANY, LP E.P. TOXICITY METALS RESULTS

# All values are mg/L.

<u>Parameter</u>	<u>A-1</u>	<u>A-2</u>	A-3	<u>A-4</u>	<u>A-5</u>	A-6
Arsenic	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	0.26	0.22	0.25	<0.20	0.36	0.21
Cadmium	٥.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	<0.20	<0.20	<0.20	٥٠.20	<0.20	<0.20
Mercury	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium	٠٥.5	<0.5	<0.5	٠٥.5	٠٥.5	٠0.5
Silver	<0.01	0.06	٠٥.01	0.18	<0.01	<0.01

## TABLE 1.1 30880-1039 CRITERION CATALYSTS COMPANY, LP E.P. TOXICITY METALS RESULTS

# All values are mg/L.

<u>Parameter</u>	<u>B-1</u>	B-2	B-3	B-4_	B-5	<u>B-6</u>
Arsenic	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium	<0.20	0.25	<0.20	<0.20	٥.20	<0.20
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	(0.20	<0.20	٠0.20	<0.20	<0.20	٠0.20
Mercury	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium	٠0.5	٠0.5	<0.5	<0.5	<0.5	<0.5
Silver	<0.01	0.15	0.02	<0.01	0.14	0.06

## TABLE 2.0 30880-1039 CRITERION CATALYSTS COMPANY, LP MISCELLANEOUS LEACHABLE METALS RESULTS

# All values are mg/L.

<u>Parameter</u>	<u>A-1</u>	<u>A-2</u>	<u>A-3</u>	<u>A-4</u>	<u>A-5</u>	<u>A-6</u>
Cobalt	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Molybdenum	<0.10	<0.10	٠٥.10	<0.10	0.31	<0.10
Nickel	3.13	1.61	1.14	3.00	0.69	2.59

#### TABLE 2.1 30880-1039 CRITERION CATALYSTS COMPANY, LP MISCELLANEOUS LEACHABLE METALS RESULTS

#### All values are mg/L.

<u>Parameter</u>	<u>B-1</u>	<u>B-2</u>	<u>B-3</u>	<u>B-4</u>	<u>B-5</u>	<u>B-6</u>
Cobalt	٠0.05	<0.05	٠0.05	٠0.05	<0.05	<0.05
Molybdenum	<0.10	<0.10	<0.10	<0.10	<0.10	٥.10،
Nickel	1.06	1.02	0.11	0.79	0.13	0.22

#### APPENDIX C

INJECTION WELLS CLOSURE REPORT PLUG AND ABANDON CLASS V WELLS NO. 1 AND NO. 2, GOLDEN ENVIRONMENTAL SERVICES, JANUARY 1993

#### **CRITERION CATALYSTS COMPANY**

Michigan City, Indiana

#### PLUG AND ABANDON CLASS V WELLS NO. 1 AND NO. 2

GES JOB NO. 90069-3



Prepared by:

#### GOLDEN ENVIRONMENTAL SERVICES, INC.

711 Louisiana Street, Suite 1600 Houston, Texas 77002 Telephone No.: (713) 228-7000 Fax No.: (713) 222-9900

January 7, 1993

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#### 1.0 INTRODUCTION

Golden Environmental Services, Inc. (GES) was contracted to provide engineering, design and procurement services and necessary labor, supervision, materials, tools and equipment to plug and abandon (close) the two Class V disposal wells located at Criterion Catalysts Company's Michigan City, Indiana facility.

Field operations on Class V Well No. 1 began on Monday, October 26, 1992. Operations were concluded on Saturday, October 31, 1992.

The well was plugged in accordance with the approved procedures.

Field operations on Class V Well No. 2 commenced on Sunday, November 1, 1992 and were concluded on Wednesday, November 4, 1992.

Class V Well No. 2 was plugged in accordance with approved procedures.

This report documents the work performed and materials employed during the plugging and abandonment of the two Class V disposal wells.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

January 7, 1993



#### 2.0 EXECUTIVE SUMMARY

#### 2.1 CLASS V WELL NO. 1

Class V Well No. 1 field operations began on October 26, 1992. A 5-7/8" and 4-3/4" bit were used to ream and wash the well to total depth (648'.)

The first cement plug was set using 250 sacks of Standard cement (66.3 bbls), from 648' to 530' (118' cement fill), equivalent to 24.1" hole.

The second cement plug was set using 350 sacks Standard cement (93 bbls.) from 530' to 355' (175' cement fill), equivalent to 23.4" hole size.

The third cement plug was set using 250 sacks Neat cement (52.5 bbls.) from 355' to 344' (11' cement fill).

The fourth cement plug was set using 350 sacks Standard cement (93 bbls.) from 344' to 170' (174' cement fill). Top of cement is 100' above bottom of 6" casing.

A 35-sack short plug was mixed and pumped into the well and a one barrel top-out plug was placed in the well after the 2-7/8" tubing was laid down.

Mr. Sam Williams, USEPA Region V representative, witnessed and approved the plugging operations on October 30, 1992.

All equipment was moved to Class V Well No. 2.

#### 2.2 CLASS V WELL NO. 2

Class V Well No. 2 operations began on November 1, 1992. A 4-3/4" bit and open ended 2-7/8" tubing were used to ream and wash to total depth (294'). The well was circulated clean. Pieces of plastic and scale were recovered in the returns.

The first cement plug was set using 300 sacks Class "A" cement (63 bbls.) from 294' to 286' (8' cement fill).

The second cement plug was set using 170 sacks Class "A" cement (35.7 bbls.) from 286' to 130' (156' cement fill). Top of cement is 148' above the bottom of the 6" casing.

CRITERION CATALYST COMPANY Plug and Abandon Class V Well #1 & #2 Michigan City, Indiana Facility

January 7, 1993



A 30-sack short plug was mixed and pumped into the well and a one barrel top-out plug was pumped into the well after the 2-7/8" tubing was laid down.

Mr. Sam Williams, USEPA Region V representative, witnessed and approved the plugging operations on November 2, 1992.

Field operations on the Class V Wells were concluded on November 4, 1992.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

January 7, 1993



#### 3.0 FIELD OPERATIONS REPORTS

#### 3.1 DAILY FIELD ACTIVITIES (CLASS V. WELL NO. 1)

#### Report No. 1, Monday, 10/26/92

Well had 4 psi pressure. Pumped six (6) barrels 9.0 ppg NaCl water into well. Well dead.

#### Report No. 2, Tuesday, 10/27/92

Moved in and rigged up WellTech Rig No. 384. Nippled down wellhead valve and nippled up blow out preventor. Made up 5-7/8" bit and bit sub (3.10'). Went in hole with 2-7/8" tubing. Hit obstruction at 237'. Worked pipe up and down. Set down hard. Picked up clean. Pulled out of hole. Bit and bit sub plugged with scale material. Laid down 5-7/8" bit and bit sub. Went in hole with 2-7/8" tubing open ended. Tagged obstruction at 372'. Pulled 4 stands out of hole. shut well in for night.

#### Report No. 2, Wednesday, 10/28/92

Spotted rig tank. Moved power sub to location. Rigged up Halliburton pump truck. Ran water supply line to Halliburton equipment.

Made up 4-3/4" rock bit and crossover sub (3.07'). Went in hole with 2-7/8" tubing. Tagged obstruction at 237'. Rigged up power swivel.

Washed and reamed to total depth (648'). Circulated well with fresh water. Pumped 2 barrels of 9.0 ppg NaCl water down tubing. Set back power swivel. Pulled out of hole standing back 2 stands and laid down 17 joints 2-7/8" tubing. Made up 5-7/8" bit and crossover sub (3.10'). Tripped in hole on 2-7/8" tubing. Tagged obstruction at 237'. Picked up power swivel. Washed and reamed to 648'. Pumped 4 barrels of 9.0 ppg NaCl water down tubing. Pulled 6 stands of tubing (378'). First stand drug 38,000 lbs. (string weight 7,200 lbs.) (hole falling in). Shut well in for night.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

January 7, 1993



#### Report No. 3, Thursday, 10/29/92

Went in hole to 570'. Hit several tight spots. Picked up power swivel. Went in hole to 648' (TD). Hooked up Halliburton. Well would not circulate with 700 psi. Tubing was plugged. Pulled out of hole laying down 5 joints and standing back 8 stands. Bottom joint plugged with fine sand, gravel and small amount of scale.

Went in hole with 8 stands. Picked up swivel. Washed 5 joints to bottom, pumping down tubing. Circulated down casing. No returns. Pumped down tubing. Would not circulate with 800 psi. Tubing was plugged. Pulled out of hole laying down 5 joints and standing back 8 stands. Bottom joint plugged with fine sand and scale. Went in hole with 8 stands to 450'. Picked up swivel and washed 5 joints to bottom, pumping down tubing. Circulated hole clean and worked pipe while continuing to pump down 2-7/8" tubing.

Mixed and pumped 250 sks. Standard cement with 5#/sk Cal Seal + 1/4#/sk Flo-Seal + 10% NaCl + 10#/sk Gilsonite, mixed at 14.7 ppg, yield 1.49 Ft<sup>3</sup>/sk. Pumped at 4 bpm. Pulled 6 stands. Pumped 3 barrels water to clean tubing and 1 barrel water to clean casing. Shut well in. Rigged down swivel.

#### Report No. 4, Friday, 10/30/92

Tubing pressure 7 psi. Opened well and displaced 8 barrels 9.0 ppg NaCl water down annulus and displaced 2 barrels 9.0 ppg NaCl water down 2-7/8" tubing. Lowered tubing and tagged top of cement at 530', (118' cement fill). Mixed and pumped 350 sx Standard cement, with 5 #/sk Cal Seal + 1/4#/sk Flo-Seal + 10% NaCl + 10#/sk Gilsonite, mixed at 14.7 ppg. Yield 1.49 Ft<sup>3</sup>/sk. Pumped at 4.9 bpm. Displaced cement with 7 barrels 9.0 ppg NaCl water. Pulled 2-7/8" tubing out of hole. shut well in and waited on cement four (4) hours.

Opened well. Lowered tubing and tagged top of cement at 355' (175' cement fill). Mixed and pumped 250 sx. Neat cement + 1/4#/sk Flo-Seal, mixed at 13.6 ppg. Yield 1.18 Ft<sup>3</sup>/sk, pumped at 5.0 bpm. Displaced annulus with 8 barrels 9.0 ppg NaCl water and displaced 2-7/8" tubing with 2 barrels 9.0 ppg NaCl water. Pulled out of hole and shut well in.

#### Report No. 5, Saturday, 10/31/92

Tubing pressure 7 psi. Opened well and pumped 8 barrels 9.0 ppg NaCl water down annulus and 2 barrels 9.0 ppg NaCl water down tubing.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

January 7, 1993



Went in hole with 2-7/8" tubing. Tagged top of cement at 344' (11' cement fill).

Mixed and pumped 350 sx Standard cement with 5#/sk Cal-Seal + 10#/sk Gilsonite + 10% salt + 1/4#/sk Flow-Seal, mixed at 14.7 ppg. Yield 1.49 Ft<sup>3</sup>/sk, pumped at 5.0 bpm. Displaced tubing with water. Pulled out of hole with tubing and shut well in.

Waited on cement four (4) hours.

Went in hole with 2-7/8" tubing. Tagged top of cement at 170' (174' cement fill). Top of cement 100' above 6" Carlon casing shoe.

Mixed and pumped 35 sx Neat cement, mixed at 15.6 ppg. Yield 1.18 Ft<sup>3</sup>/sk, pumped at 4.9 bpm. Displaced tubing with 9.0 ppg NaCl water. Pulled out of hole laying down 2-7/8" tubing. Topped out 6" casing with 1 barrel Neat cement mixed at 15.6 ppg.

Cement witnessed and approved by:

Mr. Sam Williams

USEPA Region V Representative

October 30, 1992

Rigged down and moved to Class V No. 2 well.

#### 3.2 DAILY FIELD ACTIVITIES (CLASS V, WELL NO. 2)

Pumped 6 barrels 9.0 ppg NaCl water in well on 10/26/92.

#### Report No. 1, Sunday, 11/01/92

Tubing Pressure 0. Moved in and rigged up WellTech Rig No. 384. Removed 6" valve and nippled up blowout preventor. Strapped 2-7/8" tubing and picked up 4-3/4" bit and bit sub (3.07') Went in hole with 2-7/8" tubing. Hit obstruction at 271'.

Pulled out of hole and ran in hole with 5-7/8" bit and bit sub (3.10'). Could not pass below 6' sch, 40 SS crossover to 6" Carlon at 6'. Tried several times. Pulled out of hole.

Ran in hole with 2-7/8" tubing open ended and tagged bridge at 271'. Washed and reamed from 271' to 272'. Unable to pass below 272'. Pulled out of hole.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

January 7, 1993



Picked up 4-3/4" bit and bit sub (3.07'). Ran in hole to bridge at 272'. Started circulating and rotating tubing. Broke through bridge in 20 minutes and lowered tubing to 284'. Tagged obstruction. Rotated through bridge from 284' to 288'. Lowered tubing to TD 294' and circulated hole for 20 minutes. Pulled into casing. Shut well in for night.

Note: After circulating 85 barrels at 284' started getting scale material in returns.

#### Report No. 2, Monday, 11/02/92

Tubing pressure 7 psi. Opened well. Lowered 2-7/8" tubing. Tagged bottom at 294'. Circulated well bore clean. Pulled out of hole with 2-7/8" tubing and 4-3/4" bit. Ran in hole with 2-7/8" tubing open ended.

Mixed and pumped 300 sks. Class A cement, 15.6 ppg, yield 1.18 (63 barrels) at 4.8 bpm. Displaced tubing with 1-1/2 barrels 9.0 ppg NaCl water. Pulled out of hole laying down tubing. Waited on cement five (5) hours.

Ran in hole with 2-7/8"tubing and tagged top of cement plug at 286' (8' cement fill). Mixed and pumped 170 sks. Class A cement, 15.6 ppg, 1.18 yield, pumped at 5.2 bpm. Displaced with 1-1/2 barrels 9.0 ppg NaCl water. Pulled out of hole and washed cement out of tubing and cleaned equipment. Shut well in for night.

#### Report No. 3, Tuesday, 11/03/92

Tubing pressure 25 psi. Pressure immediately bled to "0". Opened well. Ran in hole and tagged top of cement at 130'(156' cement fill). Bottom of 6" Carlon casing shoe is 278'. Mixed and pumped 30 sks Class A cement, 15.6 ppg. Yield 1.18 Ft<sup>3</sup>/sk. Pulled out of hole laying down 2-7/8" tubing. Nippled down and washed BOP. Topped out with 1 bbl. Class A cement. Waited on cement.

Cement witnessed and approved by:

Mr. Sam Williams

USEPA Region V Representative

November 2, 1992

Clean up Deepwell No. 1, Class V Well No. 1 and Class V Well No. 2 locations. Cut casing off 4' below ground level.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Weil #1 & #2
Michigan City, Indiana Facility

January 7, 1993



#### Report No. 4, Wednesday, 11/04/92

Dug out around 16" casing and found cement slab 5' wide and 6' deep. Mel Wilkenfeld advised us that Criterion would seal wells.

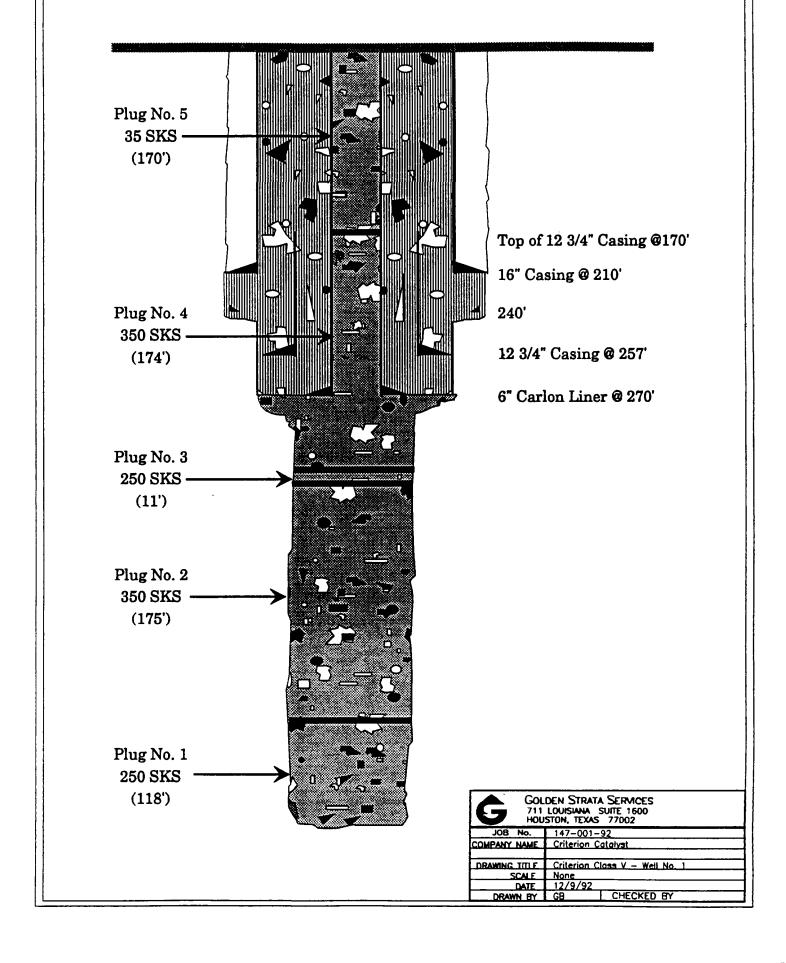
Golden Environmental Services consultant, Wes Frank was released.

CRITERION CATALYST COMPANY
Plug and Abandon Class V Well #1 & #2
Michigan City, Indiana Facility

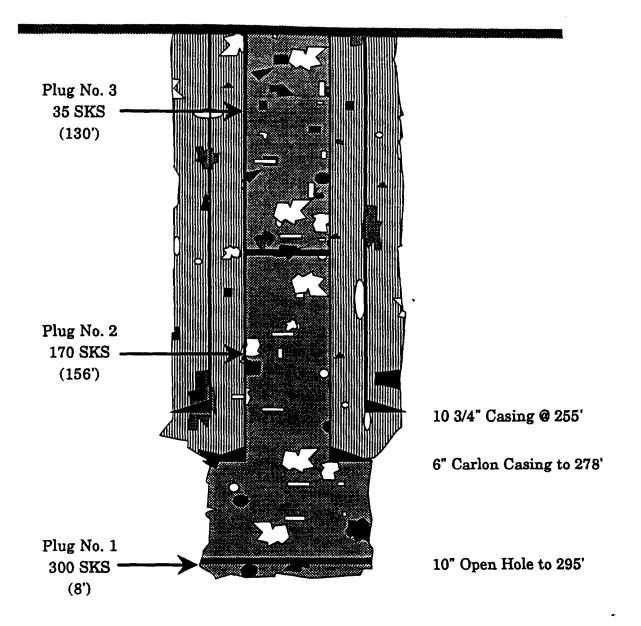
January 7, 1993



#### Criterion Class V Well No. 1



#### Criterion Class V Well No. 2



GOLDEN STRATA SERVICES 711 LOUISIANA SUITE 1600 HOUSTON, TEXAS 77002			
Job No.	147-001-92		
COMPANY NAME	Criterion Catalyst		
	Criterion Class V - Well No. 2		
SCALE	None		
DATE	12/9/92		
DRAWN BY	GRUE, HULL CHECKEOLEA		

гесуріев рарыг

#### APPENDIX D

#### GROUNDWATER ASSESSMENT REPORT NARRATIVE RAW MATERIALS TANK FARM, METCALF & EDDY, SEPTEMBER 1994



## SUMMARY REPORT RAW MATERIALS TANK FARM

#### PREPARED FOR

CRITERION CATALYSTS COMPANY L.P.
1800 EAST U.S. 12
MICHIGAN CITY, INDIANA 46360

#### PREPARED BY

METCALF & EDDY ONE PIERCE PLACE, SUITE 1500W ITASCA, ILLINOIS 60143

**SEPTEMBER 26, 1994** 

#### SUMMARY REPORT RAW MATERIALS TANK FARM

#### PREPARED FOR

CRITERION CATALYSTS COMPANY L.P.
1800 EAST U.S. 12
MICHIGAN CITY, INDIANA 46360

#### PREPARED BY

METCALF & EDDY ONE PIERCE PLACE, SUITE 1500W ITASCA, ILLINOIS 60143

**SEPTEMBER 26, 1994** 

Jacobsed Lago.

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#### **EXECUTIVE SUMMARY**

Several investigations have been conducted at the Criterion Catalyst Company L.P. in Michigan City, Indiana. The investigations were prompted by the structural damage caused by soil loss occurring in the Raw Materials Tank Farm Area. During subsequent facility upgrading, several tanks were removed from the area. In the process, Criterion discovered off-color high pH groundwater.

In October 1993, the soil and groundwater media were sampled to assess the impact on groundwater and soils from operation of the Raw Material Tank Farm. Soil and groundwater samples were collected from the Raw Materials Tank Farm Area. Groundwater samples were collected from monitoring wells and a well-point sample. Two groundwater samples were collected from the well point location; one at the shallow groundwater interval and one from the approximate base of the sand aquifer.

The analytical results generated from the field investigation have identified the following parameters in the upper aquifer at the Raw Materials Tank Farm:

- elevated pH levels;
- alkalinity levels;
- TDS concentrations;
- specific conductance readings; and
- sodium concentrations.

Based on analytical results, elevated sodium concentrations correspond with elevated pH levels, total alkalinity levels, TDS concentrations, and specific conductance measurements. Total alkalinity, pH, TDS, specific conductance, and sodium were detected above the site background concentrations in monitoring well CR-3. The same constituents were detected above the site background concentrations in MW-1. Monitoring wells MW-1 and CR-3 are located adjacent to the Raw Materials Tank Farm.

One soil sample was collected from the MW-1 borehole. The soil sample was collected above the water table, from the 2 to 4 foot interval. Soil sample analysis revealed a pH of 9.2. Other common soil constituents were detected, however the concentrations were within site background levels. Based on the October 1993 and earlier findings, elevated pH levels and sodium were considered the constituents of concern for the Raw Materials Tank Farm Area. In May 1994, a Phase I-A investigation was conducted and focussed on delineating the vertical and horizontal extent of the sodium and pH plumes.

The Phase I-A investigation consisted of collecting additional groundwater samples in an effort to delineate the extent of impact to groundwater by the constituents of concern. A total of 43

rawmatrl.rpt ES-1

groundwater samples were collected from 39 discrete locations using a Geoprobe<sup>TM</sup> unit. Of the 43 samples collected, 29 were collected at the top of the aquifer (approximately 4 feet below grade). The remaining 35 samples were collected from the base of the aquifer (approximately 28 feet below grade).

According to the Phase I-A analytical results, elevated pH levels are predominantly found at the base of the aquifer. The pH levels at the surface are near neutral. The site-wide pH plume associated with the Raw Materials Tank Farm has been delineated. The majority of the plume is within the fenced compound, but a small area does extend south of the fence slightly beyond the parking area.

Sodium concentrations were defected above background concentrations at the perimeter of the fence. The Phase I-A investigation was limited to on-site sampling locations. Sodium concentrations at the fence boundary only range from 3,400 ppm to 4,310 ppm. These concentrations are significantly less than the highest concentration detected (24,900 ppm) at monitoring well CR-3. The highest background concentration for sodium is 110 ppm.

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### RAW MATERIALS TANK FARM SUMMARY REPORT CRITERION CATALYSTS COMPANY L.P.

#### 1.0 INTRODUCTION

The Raw Materials Tank Farm Summary Report presents the findings of several field investigations which were conducted at the Criterion Catalyst Company L.P. (Criterion) site in Michigan City, Indiana from September, 1989 through May, 1994. The investigations were prompted by the structural damage caused by soil loss occurring in the Raw Materials Tank Farm Area and the off-color high pH groundwater that was discovered during construction. This report presents data describing soil and groundwater conditions associated with the Raw Materials Tank Farm Area. Geologic and hydrogeologic conditions existing at the site are also described in this report.

#### 1.1 Site Description

The Criterion facility is located at 1800 East U.S. 12 in Michigan City, Indiana. The facility occupies a 40-acre site on the north side of Highway 12 in the southwest corner of Section 22 of Township 38 North, Range 4 West in La Porte County. The site is approximately one-quarter mile south of Lake Michigan. Refer to Figure 1-1, Site Features Map.

#### 1.2 Site History

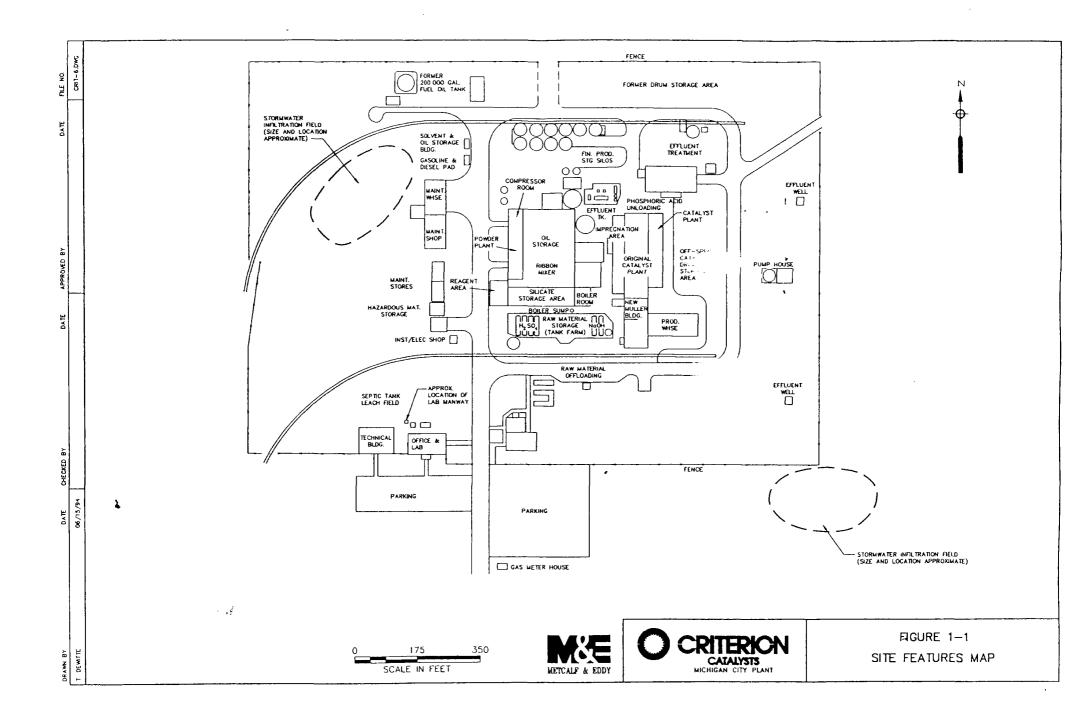
The manufacturing facility has occupied a portion of the 40-acre site since its construction in 1951. The facility was owned and operated by American Cyanamid from 1951 until 1988, at which time Criterion was formed as a limited partnership between American Cyanamid and the Shell Companies.

The site has produced alumina powder for manufacturing of catalyst and hydrotreating catalysts. The chemical raw materials (ammonia hydroxide, caustic soda, and acids) are stored in above ground storage tanks in the Raw Materials Tank Farm Area located south of the plant buildings. Other raw materials previously stored in the tank farm area included sodium silicate.

The tank farm lacked a containment structure until 1987. In mid to late 1987, a concrete diking system (floors and wall) was constructed in the tank farm area. During subsequent facility upgrading, several tanks were removed. In the process, Criterion discovered off-color high pH groundwater. These findings prompted further investigations.

In response to a reported spill of caustic soda in 1984, a recovery well was installed. Groundwater recovery was conducted utilizing one 6-inch diameter recovery well. However, since the pH levels did not decrease through groundwater extraction, groundwater recovery ceased in 1988. Historical records indicated elevated pH levels in groundwater samples collected from monitoring wells installed around the vicinity of the Raw Materials Tank Farm Area.

rawmatrl.rpt 1-1



#### 2.0 INITIAL SUBSURFACE INVESTIGATIONS

Several investigations have been conducted at the Raw Materials Tank Farm Area. The investigations were prompted by structural damage caused by soil loss resulting from erosion. The erosion was caused by leaking underground pipes. The first investigation was conducted in 1989 by Envirocorp Services and Technology, Inc. (Envirocorp) of South Bend, Indiana. Based on the initial findings, Envirocorp. conducted a Phase II investigation in March 1990. In August 1992, Geraghty & Miller of Indianapolis, Indiana conducted a Subsurface Investigation at the facility which included the Raw Materials Tank Farm Area.

#### 2.1 Phase I - Envirocorp Investigation Results

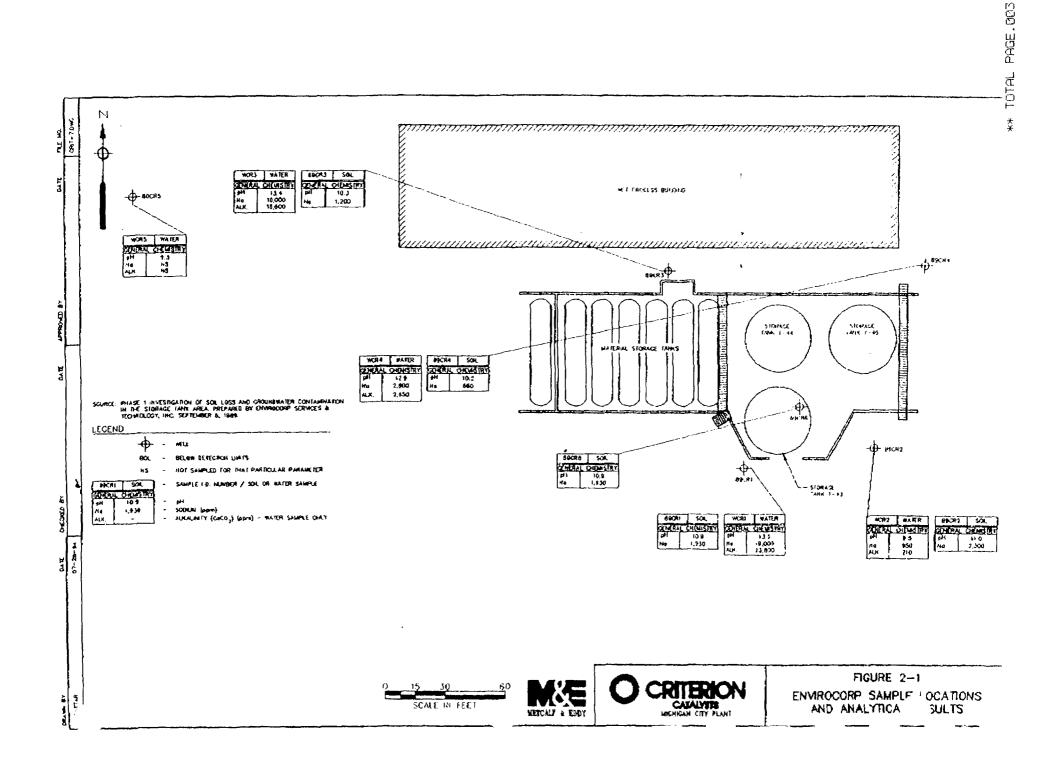
The first investigation performed by Envirocorp in 1989 consisted of evaluating the structural damage caused by soil loss and to determine the nature and extent of impact to the upper aquifer. The raw materials stored in the tank farm consisted of sodium hydroxide (NaOH) and sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). Envirocorp conducted a visual inspection of the plant and a soil boring field investigation to assess the amount of soil loss. Areas of potential soil loss were identified based on structural damage that could be observed. The investigation revealed voids approximately 24-inches thick beneath the concrete slab underlying the storage tanks. Envirocorp estimated that approximately 19 cubic yards of soil loss occurred. It was concluded that soil loss occurred due to erosion resulting from pipe leaks.

Six monitoring wells were installed in the upper aquifer. The monitoring wells were completed in the clay to prevent vertical migration. All of the monitoring wells (89CR1 through 89CR6) were installed around the tank storage area except that monitoring well 89CR5 which was installed in a downgradient position. Soil samples collected from monitoring well boreholes 89CR1, 89CR2, 89CR3, 89CR4, and 89CR6 were analyzed for pH, sulfate, ammonia, silica, sodium, and U.S. EPA priority pollutants which included; metals, pesticides, polychlorinated biphenyls (PCBs), bases/neutrals/acids, and volatile organic compounds (VOCs). Groundwater samples were collected from monitoring wells 89CR1, 89CR2, 89CR3, and 89CR4. The groundwater samples were analyzed for pH, sulfate, ammonia, silica, sodium, and priority pollutants.

The soil sample analytical results indicated the presence of elevated pH levels, sodium, sulfate, and soluble silicate. The pH levels ranged from 10.2 to 11.0. The highest pH reading was detected in 89CR2. Metals such as arsenic, cadmium, chromium, copper, nickel, selenium, thallium, and zinc were detected above the sample quantitation limit (SQL). Pesticides were detected in concentrations ranging from 0.2 ppb to 1.5 ppb. Other priority pollutant constituents such as PCBs, bases/neutrals/acids, and VOCs were not detected in the soil sample results. Refer to Figure 2-1 for Envirocorp sample locations and the corresponding analytical results.

The groundwater sample analytical results indicated the presence of elevated pH levels, alkalinity, sodium, sulfate, and soluble silicate. The pH levels ranged from 9.5 to 13.5. The highest pH reading was detected in monitoring well 89CR1. Metals such as arsenic, cadmium, copper, lead, nickel, silver, and zinc were detected above the SOL. Phenols were detected in

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each monitoring well sampled. The phenol concentrations ranged from 6.1 ppb to 14.0 ppb. Other priority pollutant constituents such as PCBs, bases/neutrals/acids, and VOCs were not detected in the groundwater sample results.

#### 2.2 Phase II - Envirocorp Investigation Results

The Phase II investigation was conducted on October 9, 1989. In an effort to further delineate the extent of the pH plume, additional borings were advanced. Eighteen borings were advanced to an average depth of 17 feet below grade. Groundwater samples were obtained from each borehole and field screened for pH. The field screening results indicated pH levels ranging from 5.87 to 11.38. The highest pH readings were obtained from boreholes A2, A10, and A11 at levels of 11.38, 10.06 and 10.31, respectively. Borehole A2 was located adjacent to monitoring well 89CR5. Boreholes A10 and A11 were located south of the parking area. The remaining pH readings ranged from 5.87 to 8.43. Refer to Figure 2-2 for the Phase II investigation results.

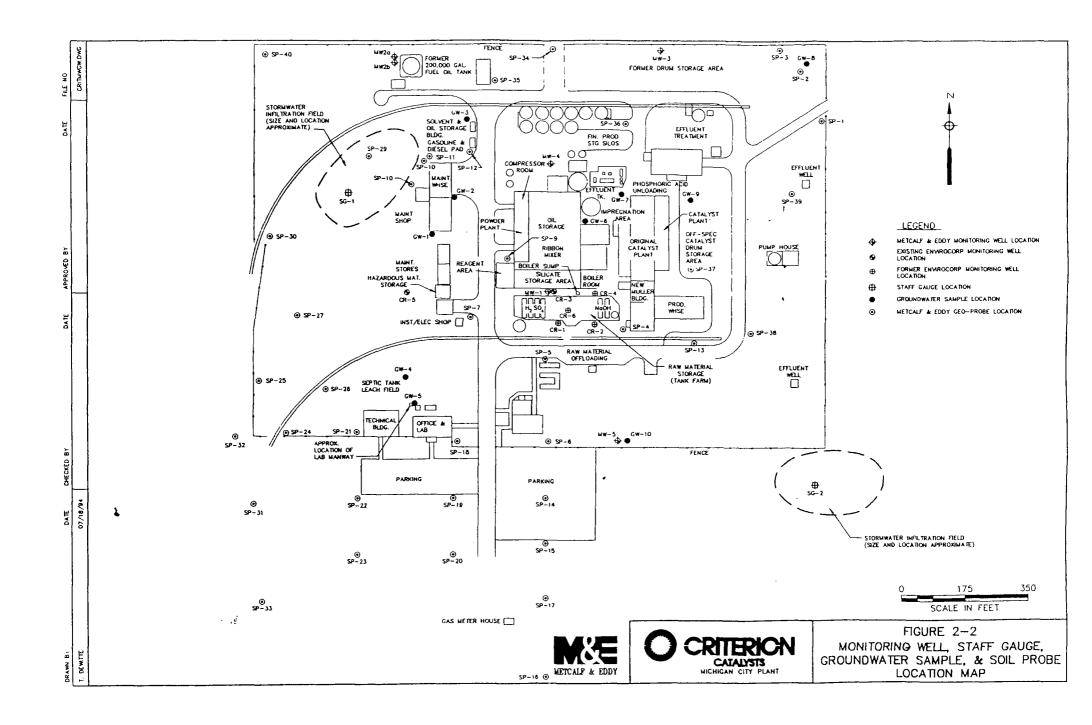
#### 2.3 Geraghty & Miller Investigation Results

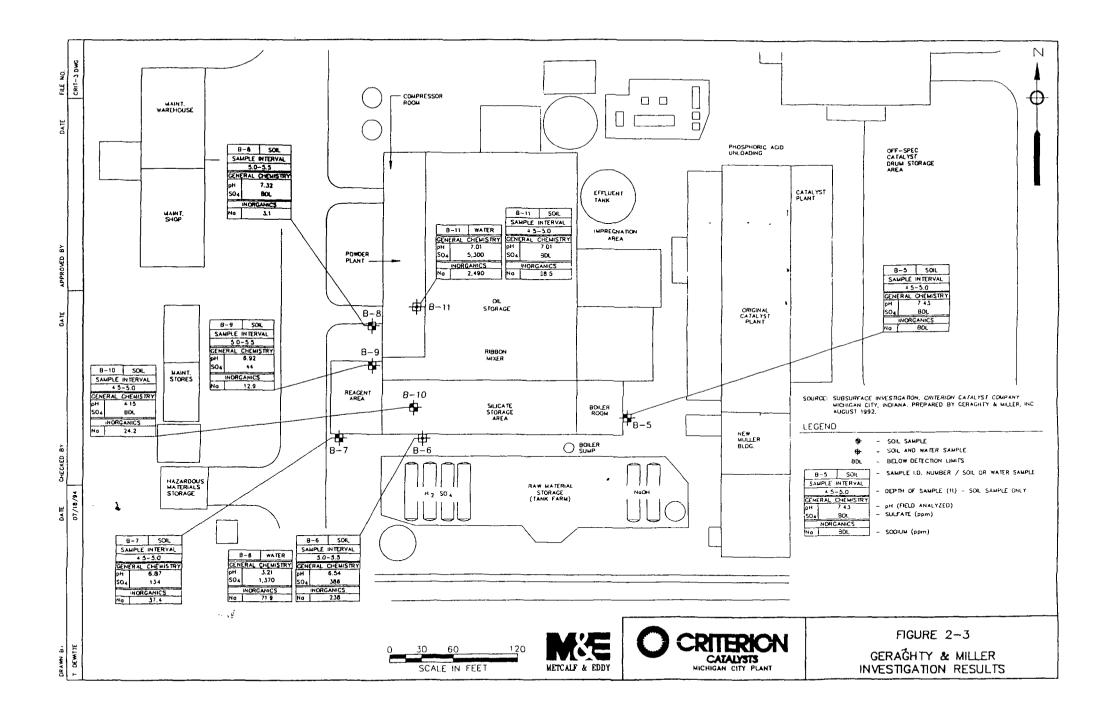
In August 1992, Geraghty & Miller conducted a site investigation that included using ground penetrating radar (GPR) and collecting soil and groundwater samples from locations adjacent to the Raw Materials Tank Farm Area. The GPR survey was conducted to locate areas of soil loss and to evaluate the amount of soil loss. Several anomalies were detected by the GPR survey at locations between the Powder Plant and the Raw Materials Tank Farm Area. However, the anomalies were attributed to underground utilities and not to soil erosion.

Seven boreholes (B-5, B-6, B-7, B-8, B-9, B-10, and B-11) were advanced north of the Raw Materials Tank Farm Area. Groundwater samples were collected from two of the boreholes (B-6 and B-11). Each borehole was advanced to the top of the water table, approximately 6 to 8 feet below grade. The soil samples were collected above the saturated zone and were analyzed for cobalt, molybdenum, nickel, phosphorus, tungsten, sodium, sulfate, nitrate, pH, and total petroleum hydrocarbons (TPH).

Soil pH levels ranged from 4.15 to 7.43. The lowest pH reading was collected from borehole B-10 located inside the Powder Plant. The groundwater pH readings for boring B-6 and B-11 were 3.21 and 7.01, respectively. Other constituents such as tungsten, molybdenum, nickel, phosphorus, sulfate, sodium, nitrate, and TPH were detected in the boring sample analytical results. Refer to Figure 2-3, Geraghty & Miller Investigation Results for sample locations and corresponding analytical results.

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#### 2.4 Metcalf & Eddy Investigations

Metcalf & Eddy, Inc. (M&E) was contracted by Criterion to delineate the impact to soils and groundwater resulting from Raw Materials Tank Farm releases. M&E conducted two investigations, a Phase I investigation in October 1993 and a Phase I-A investigation in May 1994. The M&E investigations focused on the uppermost aquifer. The analytical results obtained from the M&E investigations are presented in Chapter 3.0. The site-specific geologic and hydrogeologic findings are presented in Chapter 4.0.

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#### 3.0 SUMMARY OF M&E INVESTIGATION RESULTS

M&E conducted two field investigations at the facility, a Phase I investigation was conducted in October 1993 and a Phase I-A investigation was conducted in May 1994.

#### 3.1 Phase I Investigation

The purpose of the Phase I investigation was to evaluate the impact on site soils and/or groundwater at the Raw Materials Tank Farm Area. The Phase I investigation included soil sample collection, monitoring well installation and groundwater sampling. Geologic and hydrogeologic conditions were documented during the investigation.

#### 3.1.1 Soil Sampling Procedures and Results

The investigation began by advancing a soil boring to determine if impacted soil was present in the Raw Materials Tank Farm Area. Continuous split-spoon samples were collected during boring. The soil samples were field screened for pH and volatile organic compounds. One sample from each borehole was submitted for laboratory analyses that included TPH for both diesel range hydrocarbons and gasoline range hydrocarbons, selected metals, and volatile organic compounds. Three soil samples were collected from upgradient locations that were not known to be impacted by plant operations and are considered representative of background for the purpose of this study. Soil borings were advanced to the top of the groundwater table. Due to shallow groundwater conditions at the site (less than 6 feet below grade), soil borings were completed using split-spoon samplers. All soil samples were collected from above the water table.

Since soil sampling was performed on a continuous basis, the specific soil sample interval to be submitted for laboratory analysis was determined by considering the criteria of pH, PID readings, and depth to groundwater. Split-spoon samplers were decontaminated prior to and during advancement. The procedures outlined in Section A.7, Decontamination Procedures, Appendix A, were followed. The shallow borings were backfilled with bentonite chips to existing grade and hydrated with potable water.

Soil samples were collected from monitoring well MW-1 and MW-5 boreholes. The MW-1 and MW-5 soil samples were collected from 2 to 4 feet and 0 to 2 feet below grade, respectively. Each soil sample was analyzed for pH and sodium.

The soil sample collected from monitoring well MW-1 revealed a pH of 9.2. The background pH level was 6.42. Refer to Figure 3-1, Raw Materials Tank Farm Area Phase I Results for sample locations and constituent concentrations.

#### 3.1.2 Groundwater Sampling Procedures and Results

Six monitoring wells were installed during the Phase I investigation. The upgradient well (MW-5) is representative of background conditions. Split-spoon samples were continuously collected

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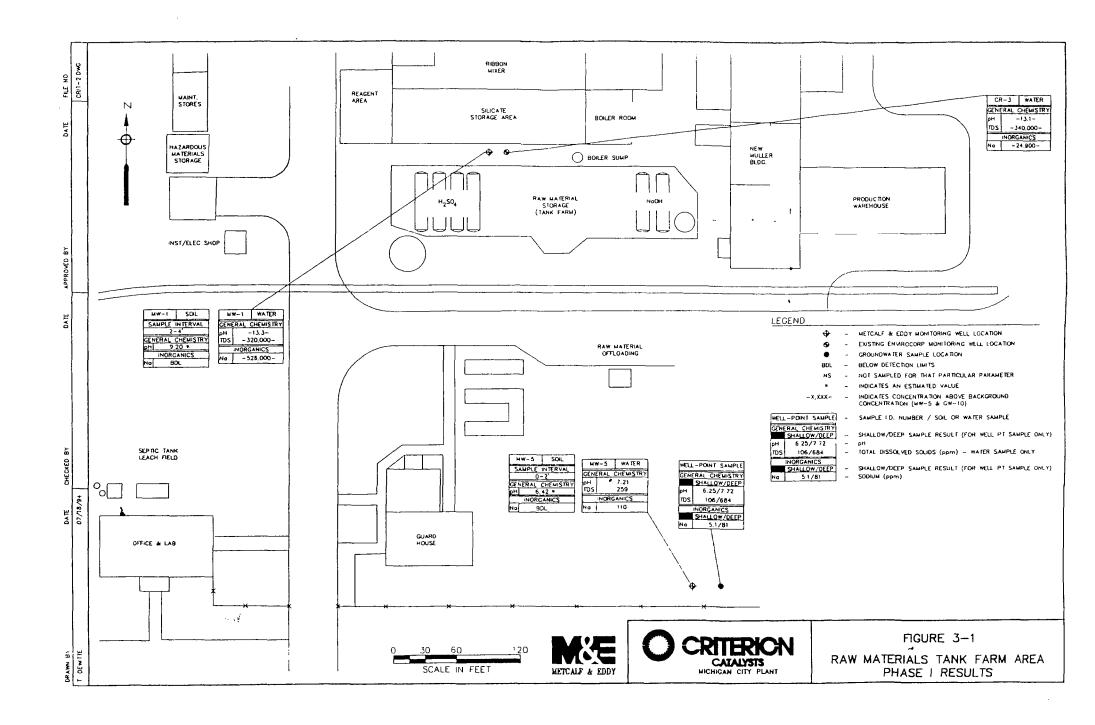
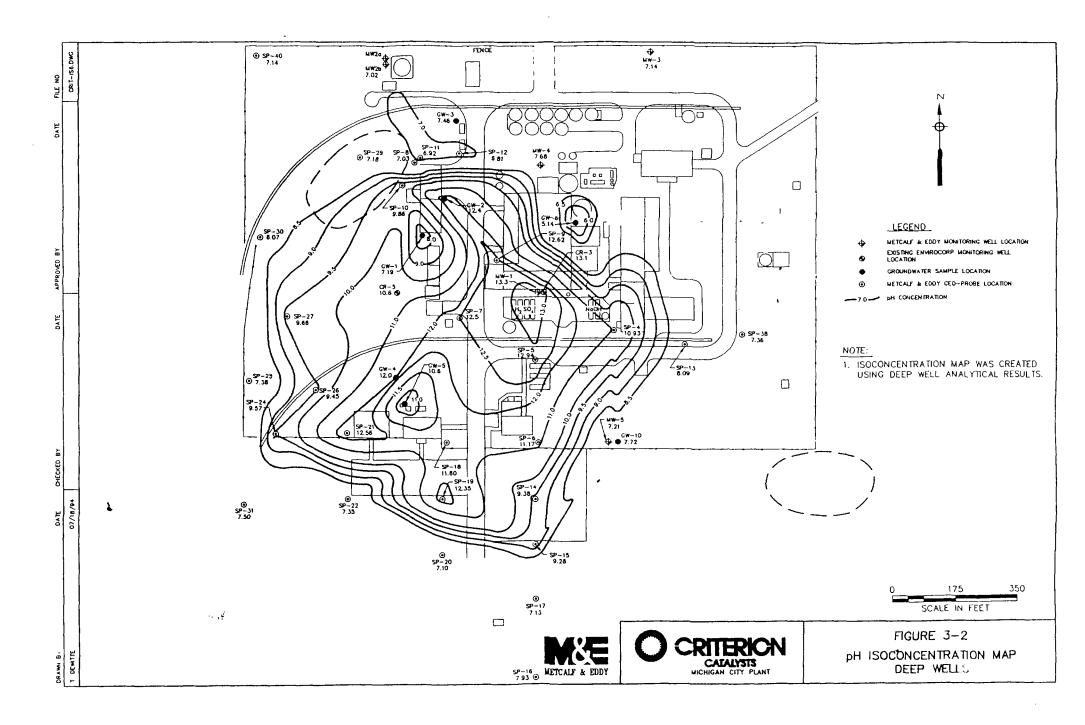


TABLE 3-1

#### FIELD SCREENING RESULTS CRITERION CATALYST COMPANY, L.P.

<u> </u>	PH	SC
	(std. units)	(uS/cm)
RAW MATERIALS	OFFLOADING AREA	130,0,
SP-4A	7.67	2100
SP-4B	10.93	5350
SP-5A	7.30	1030
SP-5B	12.94	>10000
SP-6A	7.10	406
SP-6B	11.17	1530
SP-7A	7.32	1600
SP-7B	12.5	>10000
SP-8A	7.54	384
SP-8B	7.03	3730
SP-9A	7.21	488
SP-9B	12.62	>10000
SP-10A	7.15	712
SP-10B	9.86	2920
SP-11B	6.92	2770
SP-12A	7.16	699
SP-12B	6.81	1970
SP-13A	6.78	1450
SP-13B	8.09	1260
SP-14A	6.54	260
SP-14B	9.38	1030
SP-15A	7.14	920
SP-15B	9.28	831
SP-16B	7.93	1250
SP-17B	7.19	5910
SP-18A	7.00	1929
SP-18B	11.60	2900
SP-19A	7.21	1120
SP-19B	12.35	>10000
SP-20A	6.30	772
SP-20B	7.29	7600
SP-21A	7.25	704
SP-21B	12.56	>10000
SP-22B	7.35	5620
SP-23B	8.25	5570
SP-24B	9.57	NS
SP-25A	6.92	NS
SP-25B	7.69	NS
SP-26A	6.78	NS
SP-26B	9.45	NS
SP-27B	9.66	NS
SP-29B	7.18	NS
SP-38A	7.52	NS
SP-38B	7.53	NS
SP-40A	6.75	NS
SP-40B	7.14	NS
L		

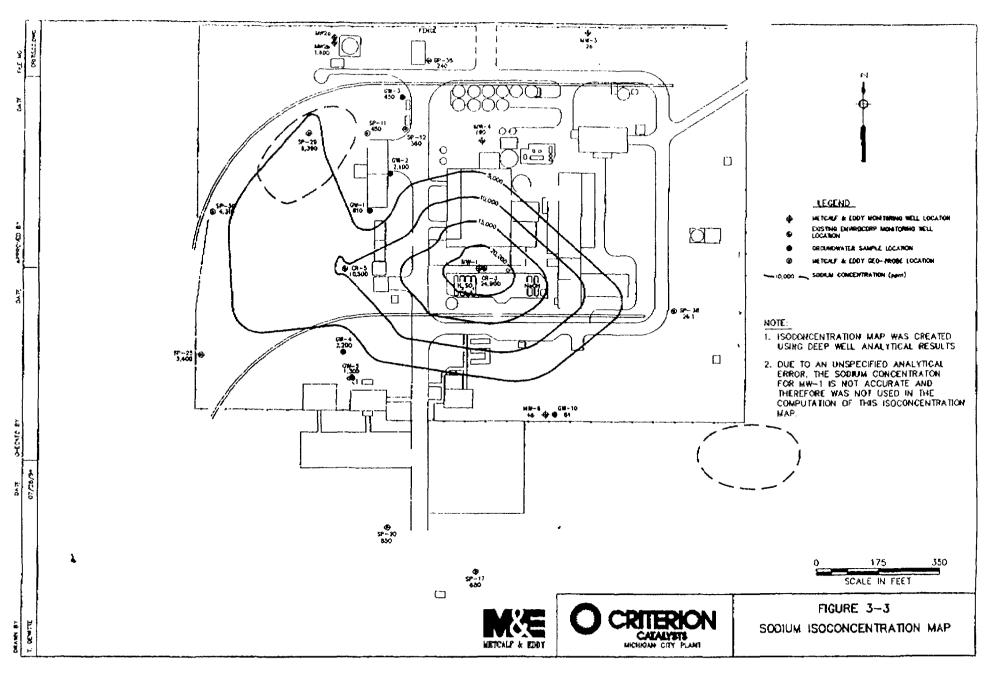
A - INDICATES SHALLOW SAMPLE
B - INDICATES A DEEP SAMPLE



southwest boundaries of the elevated pH plume identified originating from the Raw Materials Tank Farm Area. All shallow samples collected exhibited pH readings similar to background.

The sodium plume originates at the Raw Materials Tank Farm Area. Monitoring well sample CR-3 indicated the highest sodium concentrations of 24,900 ppm. Monitoring well MW-1 was also sampled and analyzed for sodium. However, due to an unspecified analytical error, the result is not accurate. As groundwater samples were collected further from the Raw Materials Tank Farm Area and field screened, the sodium concentrations decreased. However, concentrations at the plant boundary (fence) were elevated above site background concentrations. Sodium concentrations at the fence boundary range from 3,400 ppm to 4,310 ppm. These concentrations are significantly less than the highest concentration detected (24,900 ppm) at monitoring well CR-3. The highest background concentration for sodium is 110 ppm. Based on these results, the sodium plume has migrated beyond the plant boundary. The Phase I-A investigation was limited to the plant boundary. Refer to Figure 3-3, Sodium Isoconcentration Map.

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#### 4.0 SITE GEOLOGY AND HYDROGEOLOGY

#### 4.1 Site Geology

M&E collected continuous split-spoon samples to characterize site stratigraphy. The borings were advanced to the base of the sand aquifer, as determined by increased percentages of silts and clays. Three soil samples were submitted for grain size analysis to confirm the increased presence of silts and clays. Geologic Logs are included as Appendix B. Refer to Figure 4-1 for a geologic cross-section of the site.

Site geology consists of an eolian (deposited by wind) sand deposit overlying glacially deposited silty sands and silty clays. The site geology is described as an approximately 27 to 36 foot thick, brown to tan, damp to wet, poorly graded sand (SP) overlying a gray silty sand to silty clay (SM-CL). The sand size fraction ranged from trace coarse to in-excess-of-90% very fine grained sand. Trace silts to approximately 50 percent silts were present, typically increasing with depth. Silty sands and a thin organic-rich peat layer (Pt) are present locally. The peat layer is typically less than 3 inches thick and its location varies vertically, and was not encountered in all borings. The silty sand and silty clay unit may serve as an aquitard, however, since boring depth was limited to encountering the silty unit, it cannot be determined whether the unit is truly an aquitard. Soil borings advanced to the silty sand-silty clay unit indicated a slight vertical dip of this unit trending to the north.

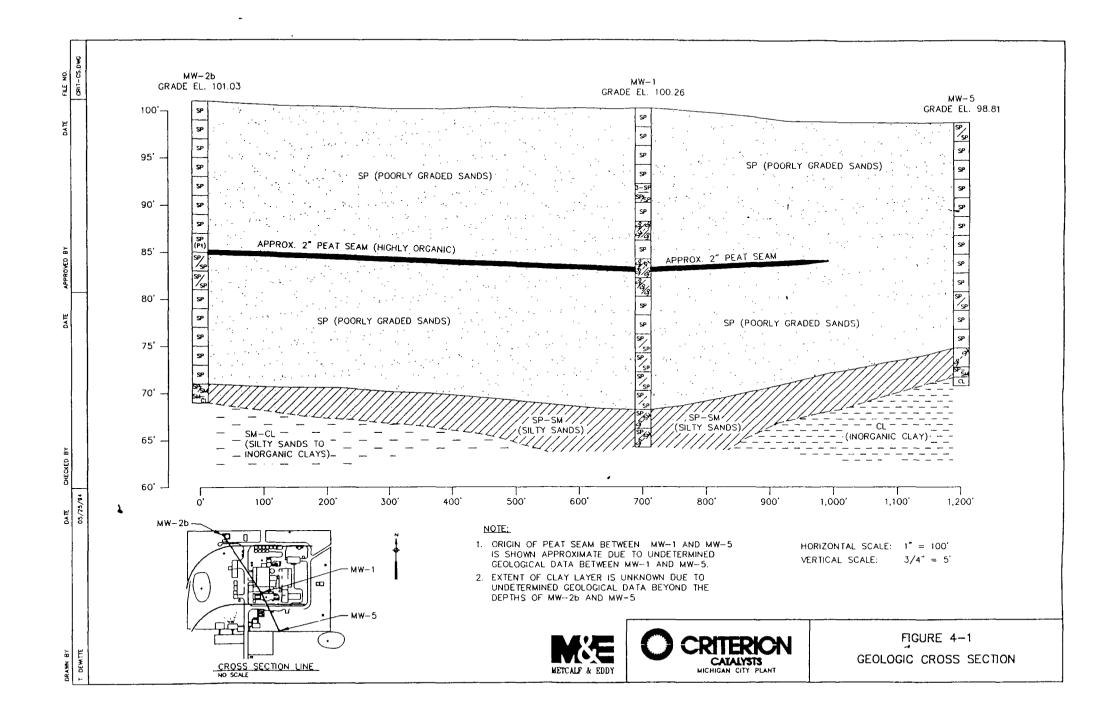
#### 4.2 Site Hydrogeology

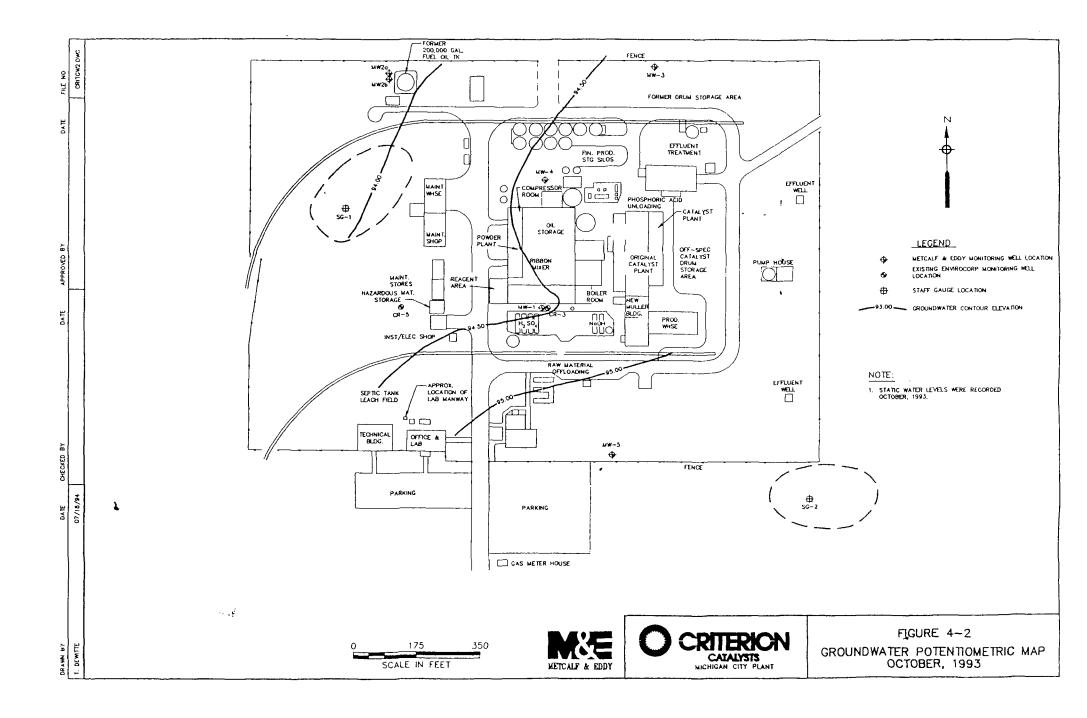
The uppermost stratigraphic unit at the facility consists of a brown to tan very fine to fine sand, with lower percentages of medium and coarse sand and silts. Monitoring wells were installed at various locations within the facility as a means for assessing groundwater quality and aquifer hydrogeologic properties. Depth to groundwater ranges from approximately 3 to 5 feet below grade. The groundwater elevations of the monitoring wells installed by M&E were plotted on the base map and equipotential lines were interpolated. Refer to Figure 4-2 for the groundwater potentiometric map. According to the equipotential lines, groundwater is generally flowing in a northwesterly direction toward Lake Michigan. The groundwater anomaly observed in the area of monitoring wells MW-1 and CR-3 resulted from dewatering activities that were being coincidentally conducted during the investigation. The dewatering activities were associated with the aboveground storage tank construction taking place in the Raw Materials Tank Farm Area.

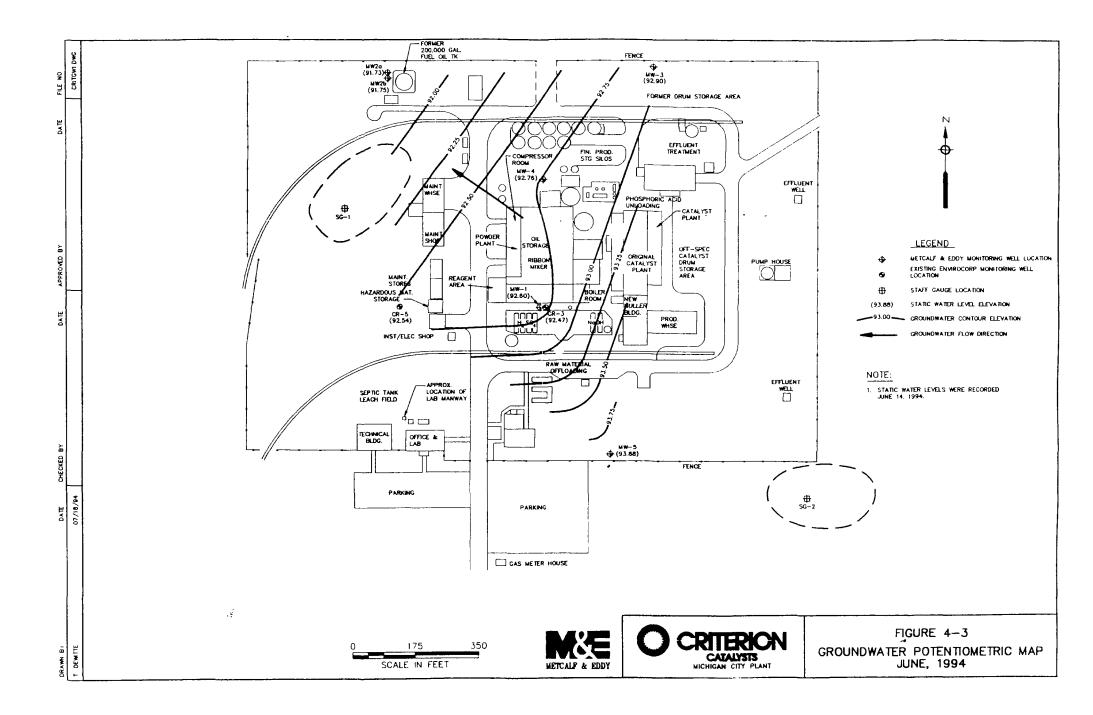
Monitoring well MW-1 was assessed during the Phase I-A investigation to determine the cause for the potentiometric anomaly that was identified during the Phase I investigation. The depth to static water level, total depth of the well, and survey elevations were assessed. Static water levels were obtained from each of the monitoring wells.

The groundwater anomaly observed in the area of monitoring wells MW-1 and CR-3 was observed during the Phase I-A investigation. During the Phase I investigation, dewatering activities associated with the aboveground storage tank construction was the suspected cause of the anomaly. However, dewatering activities are no longer being conducted but the anomaly

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#### APPENDIX E SSI SOIL SAMPLING ANALYTICAL RESULTS

Table E-1

# SSI ANALYTICAL RESULTS TAL/TCL CHEMICALS AMERICAN CYANAMID SITE MICHIGAN CITY, INDIANA

U.S. EPA ID NO.: IND005159546

Sample Designation	Sample Location	Parameter	Concentration (mg/kg)	Background (mg/kg)
S3	N. Side	Aluminum	181,000	1,400
S3	N. Side	Cobalt	71	ND
<b>S</b> 3	N. Side	Mercury	0.7	ND
<b>S</b> 3	N. Side	Nickel	3,940	3.4
<b>S</b> 3	N. Side	Dibenzofuran	0.024	ND
S3	N. Side	Fluorene	0.033	ND
S3	N. Side	Phenanthrene	0.32	19
<b>S</b> 3	N. Side	Anthracene	0.051	ND
<b>S</b> 3	N. Side	Fluoranthene	0.4	ND
<b>S</b> 3	N. Side	Pyrene	0.37	38
<b>S</b> 3	N. Side	Butylbenzylphthalate	0.086J	ND
<b>S</b> 3	N. Side	Benzo[a]anthracene	0.19	ND
S3	N. Side	Chrysene	0.22	ND
\$3	N. Side	Benzo[b]fluoranthene	0.19J	ND
<b>S</b> 3	N. Side	Indeno[1,2,3-cd]pyrene	0.12J	ND
S3	N. Side	Benzo[g,h,i,]perylene	0.13J	ND

Key: ND= Below Detection Limit

J = Estimated Value

Source: E & E FIT, March 1989, SSI Report, American Cyanamid Site.

# APPENDIX F POPULATION ESTIMATES

Table F-1  GROUNDWATER TARGETS  AMERICAN CYANAMID SITE  MICHIGAN CITY, INDIANA  U.S. EPA ID NO.: IND005159546				
Distance Interval	Number of Persons Served			
On Site	0			
0 - 1/4 mile	0			
1/4 - 1/2 mile	0			
1/2 - 1 mile	0			
1 - 2 mile	831			
2 - 3 mile	1,941			
3 - 4 mile	2,200			

Source: E & E FIT, 1991 ESIP Questionnaire, American Cyanamid Site.

# | Table F-2 | SOIL EXPOSURE TARGETS | AMERICAN CYANAMID SITE | MICHIGAN CITY, INDIANA | U.S. EPA ID NO.: IND005159546 | | Distance Interval | Number of Residents | On Site | 105 (workers) | O - 1/4 mile | 650 | 1/4 - 1/2 mile | 2,950 | 1/2 - 1 mile | 2,930 |

Source: E & E, FIT, 1991 ESIP Questionnaire, American Cyanamid Site.